At str aug 1

Monday, August 1, 2022 6:13 PM

A·M (Angular Momentum) of e^- in any subshell $(\overset{l=0}{s}, \underset{l=1}{p}, \overset{l=2}{d}, \underset{l=3}{f})$ is

$$\sqrt{l(l+1)}\ \frac{h}{2\pi}$$

Q: A·M of $\bar{e}$ in 2s subshell?

Soln :– $\boxed{A\cdot M = 0}$

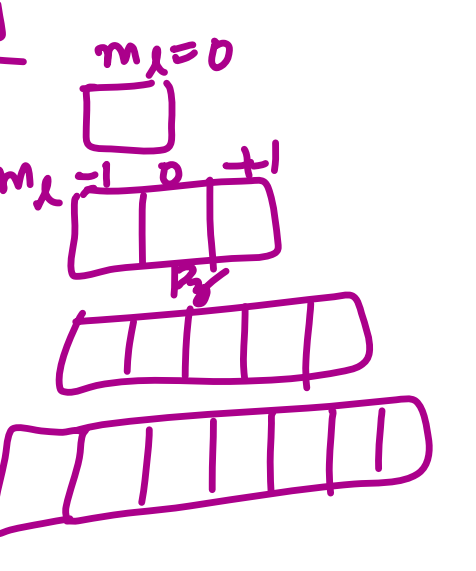
Q: A·M of e^- in 2p subshell?

Soln $\sqrt{1(1+1)}\ \frac{h}{2\pi}$ or $\sqrt{2}\hbar$

# no. of e^- in any subshell $= 2(2l+1)$

# no. of orbitals for any subshell $= \boxed{2l+1}$

Subshell	2(2l+1) no. of $\bar{e}$s	(2l+1) orbitals
s ($l=0$)	2	1
p ($l=1$)	6	3
d ($l=2$)	10	5
f ($l=3$)	14	7

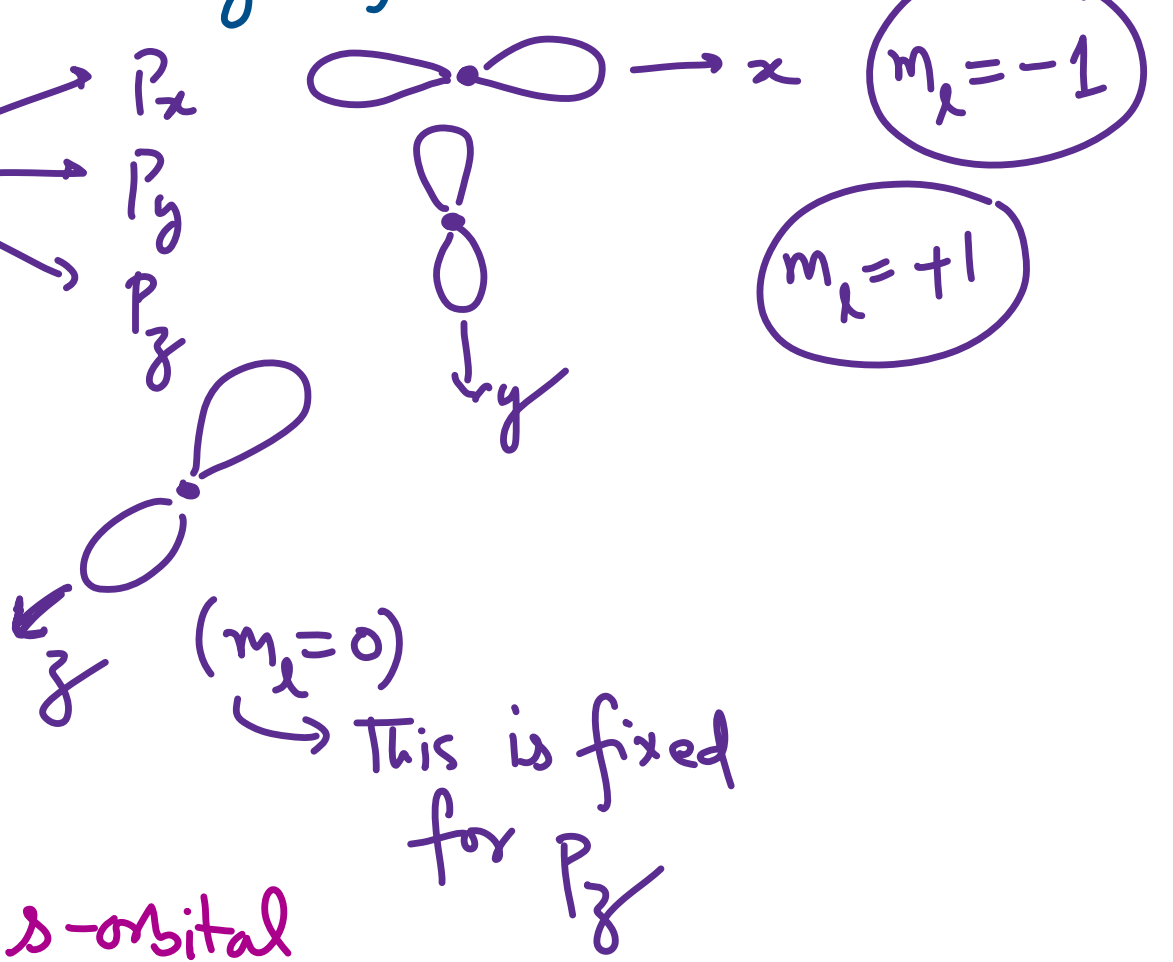


③ Magnetic Quantum No (m_l)

When Atom is Kept in Ext. Magnetic field, then subshell in any shell is arranged in different orientations & Each orientation is called orbital which is denoted by Value of m_l.

- No. of orientations of Subshell (l) = No. of m_l values
- Values of m_l for any l ranges from $-l$ to $+l$.

eg p subshell $\boxed{l=1}$ → P_x, P_y, P_z



$\boxed{m_l=-1}$

$\boxed{m_l=+1}$

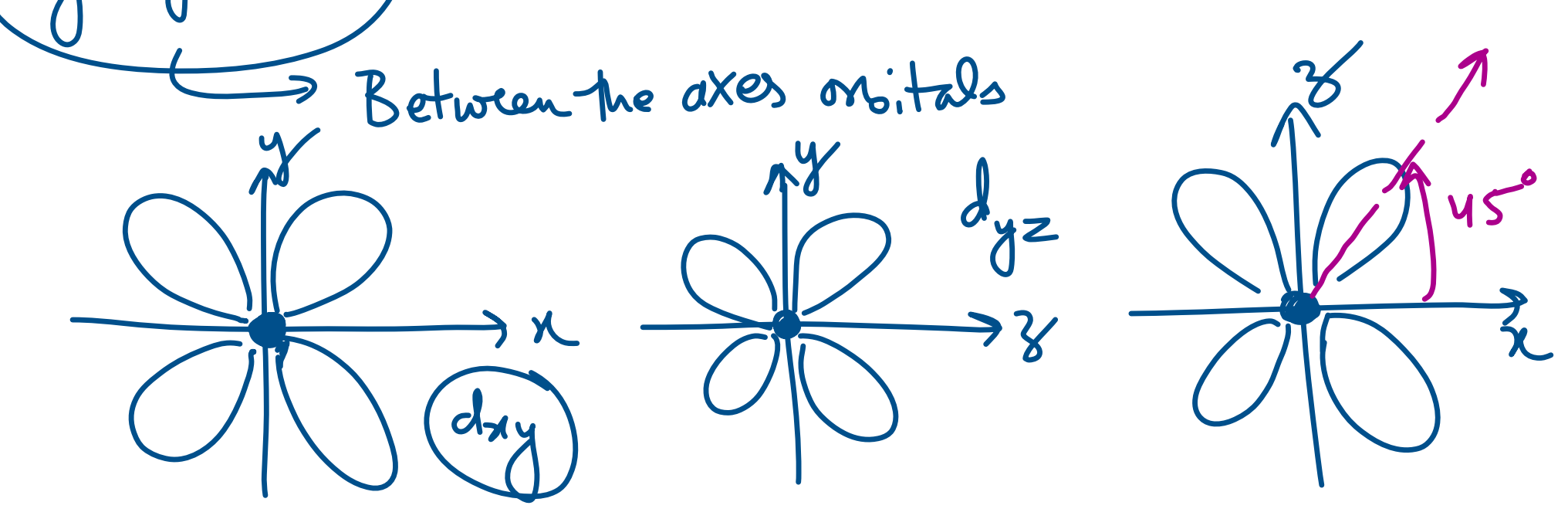
($m_l=0$) ↳ This is fixed for P_z

s-subshell $l=0$ ⇒ s-orbital $\boxed{m_l=0}$

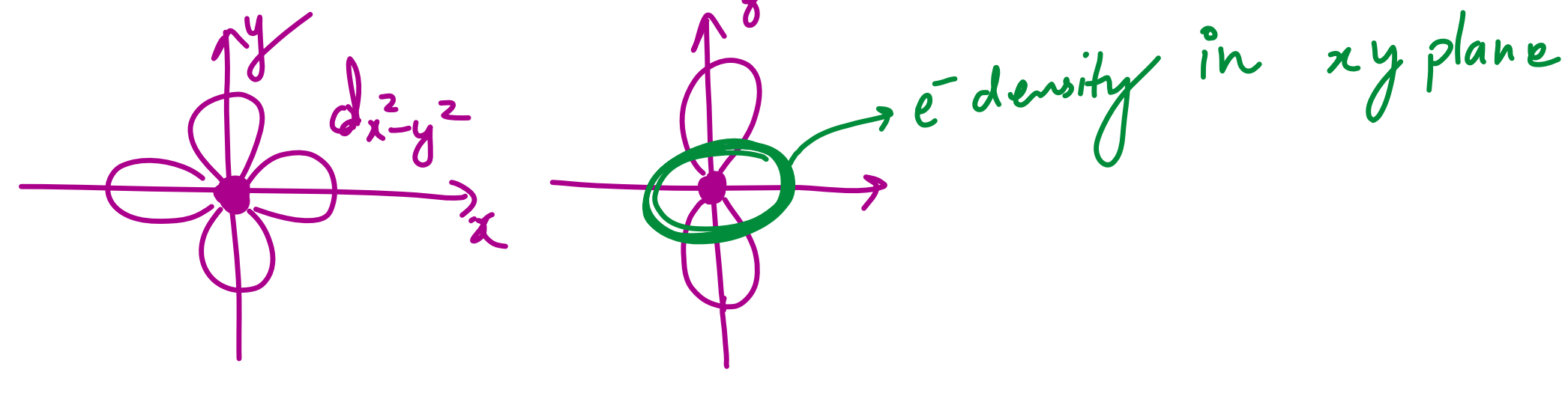
d-subshell $l=2$ ⇒

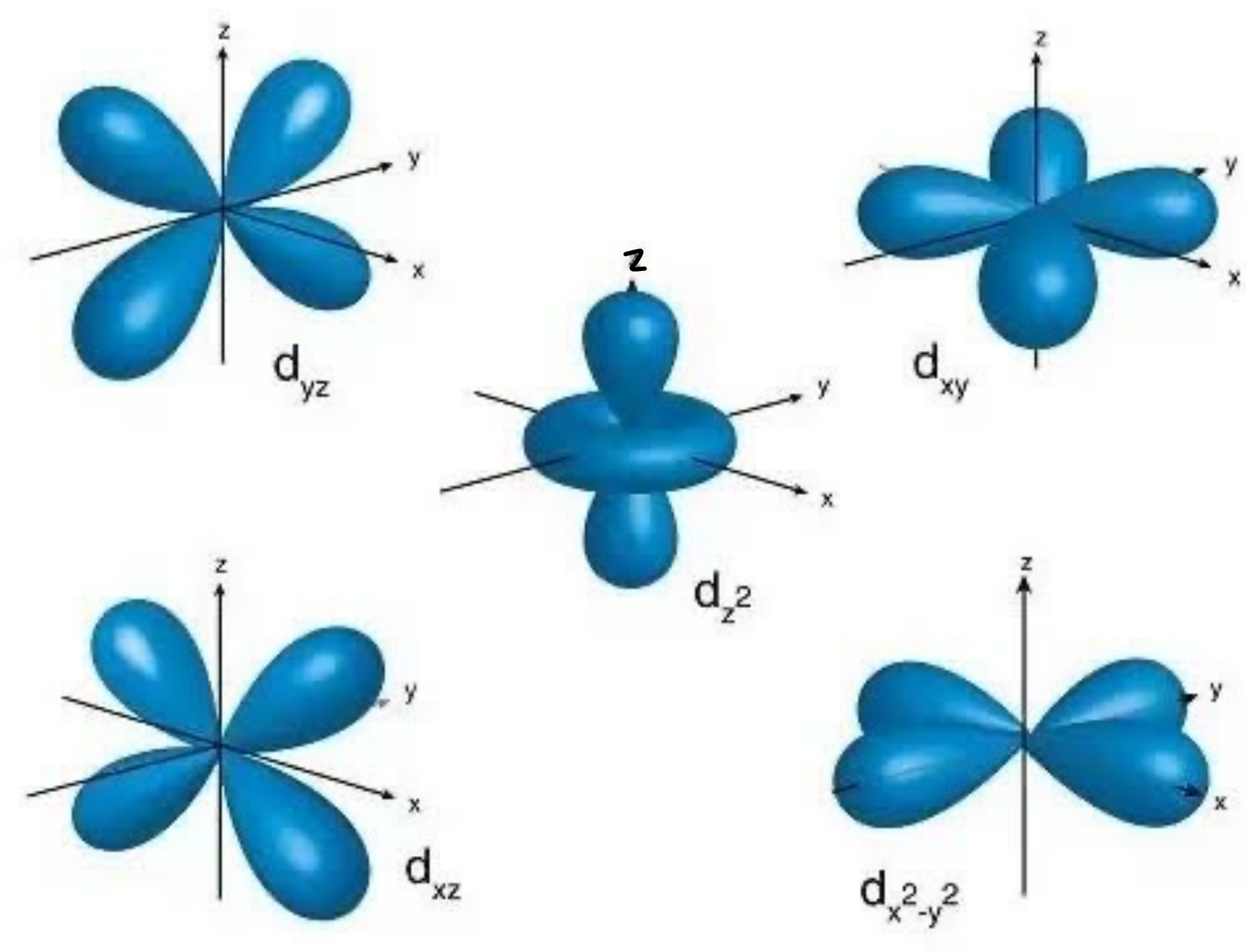
-2	-1	0	+1	+2
d_{xy}	d_{yz}	d_{z^2} (fixed)	d_{xz}	$d_{x^2-y^2}$

$\boxed{d_{xy}, d_{yz}, d_{zx}}$ → Between the axes orbitals



$\boxed{d_{x^2-y^2}, d_{z^2}}$ → Along the axes orbitals





Note :

$\boxed{n=4}$ 4th shell

- → $l=0$ 4s: $m_l=0$ [2e] 4s
- → $l=1$ 4p: $m_l=-1$ [2e], 0 [2e], +1 [2e] — $4p_y$, $4p_z$, $4p_x$
- → $l=2$ 4d: -2 [2e], -1 [2e], 0 [2e], +1 [2e], +2 [2e] — $4d_{z^2}$
- → $l=3$ 4f: -3 [2e], -2 [2e], -1 [2e], 0 [2e], +1 [2e], +2 [2e], +3 [2e]

Degenerate orbitals (Same Energy orbitals)

Total $\bar{e}$s ⇒ $\underset{4s}{2} + \underset{4p}{6} + \underset{4d}{10} + \underset{4f}{14} = \boxed{32}$ ← $2\times(4)^2$ $(2n^2)$

Q → No. of degenerate orbitals for f subshells?

Ans ⇒ ⑦

# $\psi_{3,2,0}$ ⇒ represent which orbital?

$\psi_{3,2,0}$ → n, l, m_l

Ans $\boxed{3d_{z^2}}$

Q: Which wavefn is not valid? (Multiple Correct)

Not valid 1) ✓ $\psi_{2,3,+1}$ $l \not> n$

not valid 2) ✓ $\psi_{3,3,-1}$ $l \neq n$

Valid 3) $\psi_{2,0,0}$ ②s

Valid 4) $\psi_{4,1,-1}$ $4p_x$ or $4p_y$

Nodes in orbital

↳ Region in orbital where probability of finding $\bar{e}$ is zero. ($\psi^2=0$)

Nodes → Radial Node (R·N) or Spherical Node $(RN = n-l-1)$

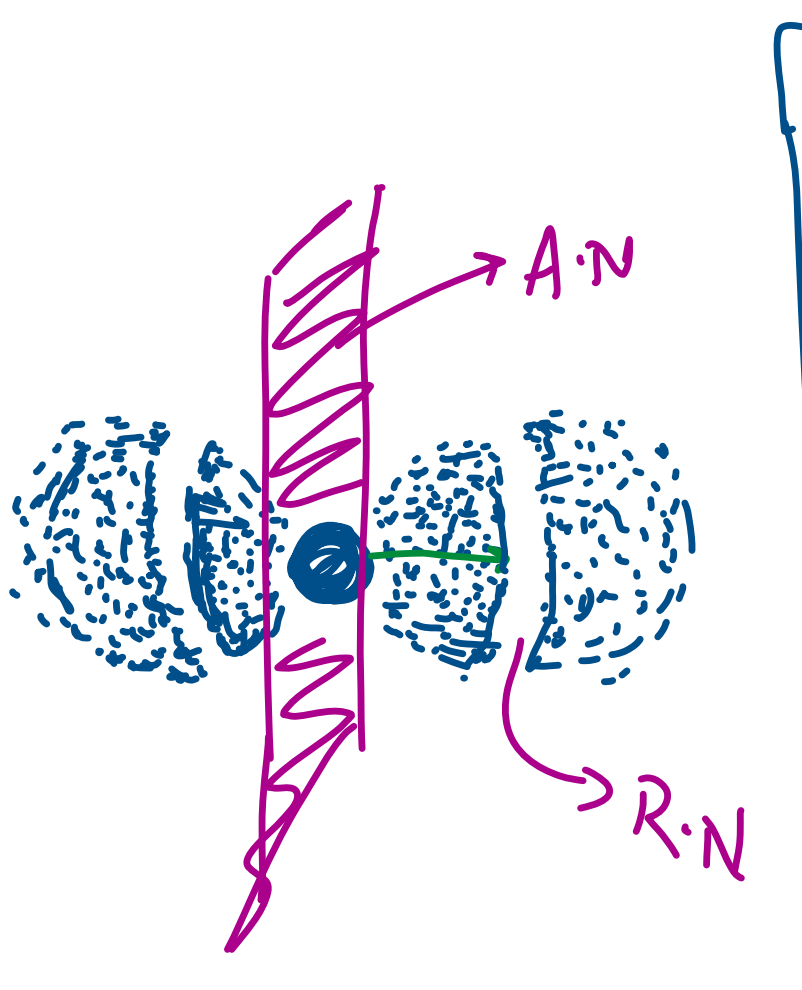
Nodes → Angular Node (A·N) or Planar Node or Surface Node $(A\cdot N = l)$

⇒ Total node (T·N) $= n-1$

orbital/subshell	(n-l-1) R·N	A·N (l)	T·N (n-1)
1s	0	0	0
2s	1	0	1
2p	0	1	1
3s	2	0	2
4p	2	1	3
5d	2	2	4
6s	5	0	5

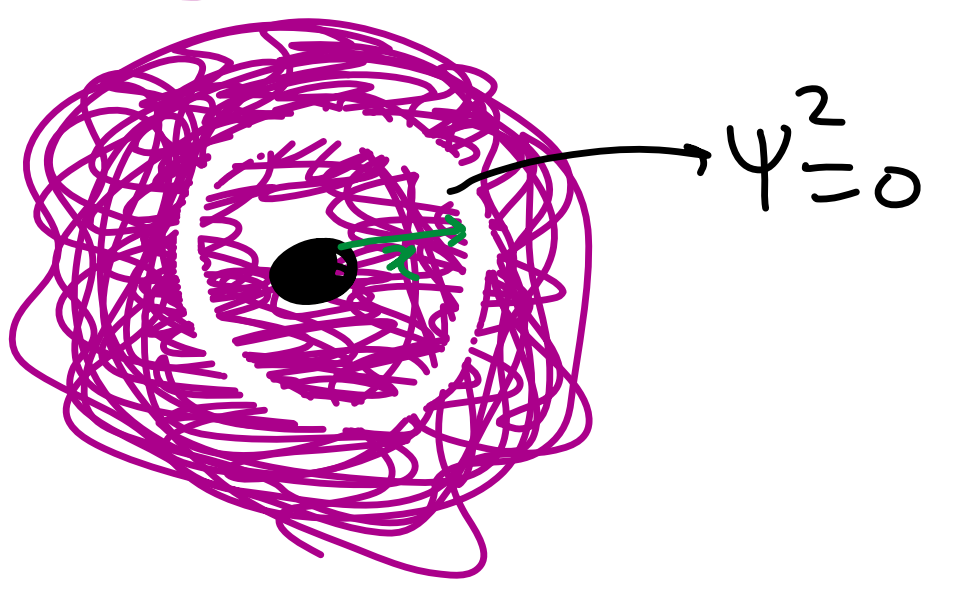
A·N, R·N Representation

$3p_x$ → RN = 1, → A·N = 1



Q.10 $\psi(r)$ or $R(r)$ $= \frac{1}{\sqrt{8}}\left(\frac{Z}{a_0}\right)^{3/2}\boxed{\left(2-\frac{Zr}{a_0}\right)}e^{-\frac{Zr}{2a_0}}$

②s $\boxed{R\cdot N = 1}$



$\psi^2(r) = 0$

$\left(2-\frac{Zr}{a_0}\right)^2 = 0$

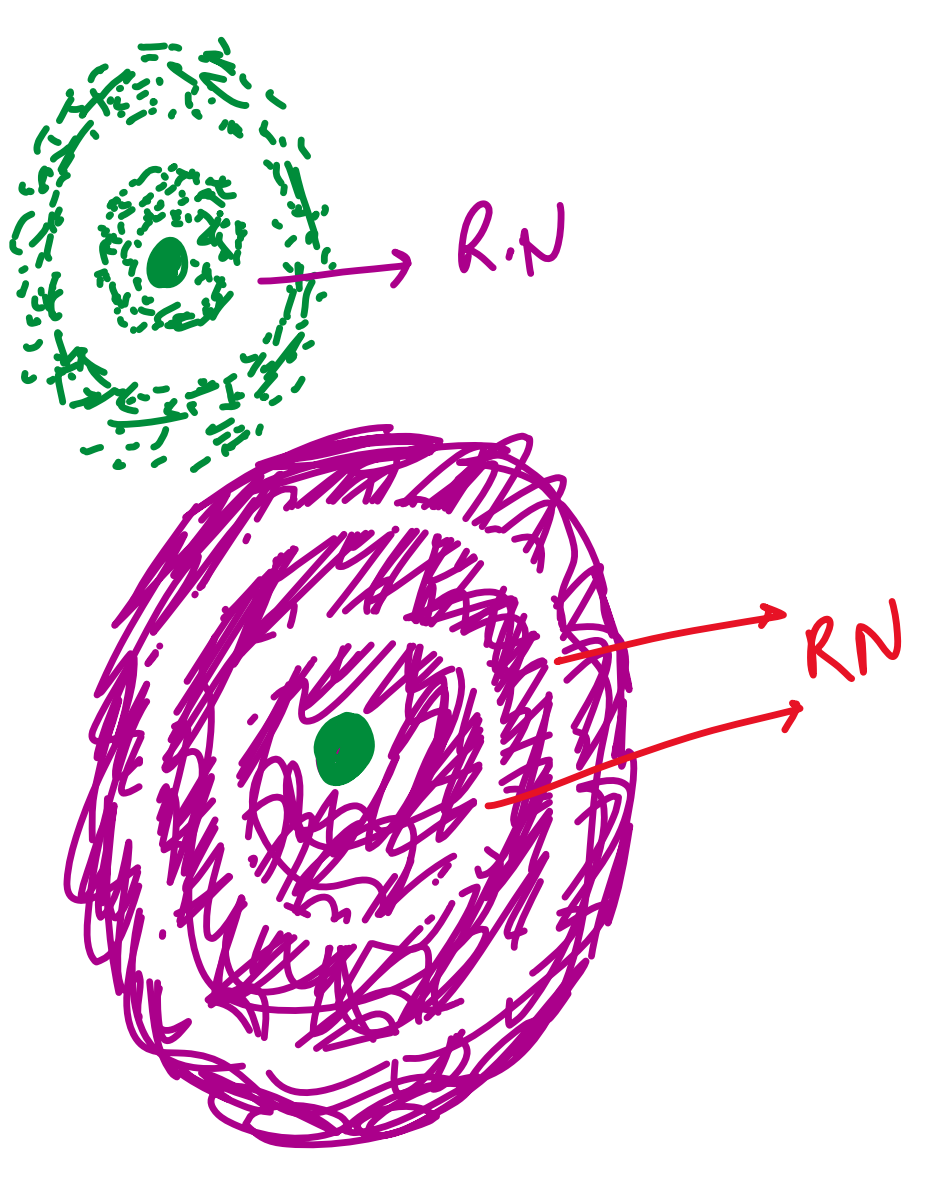
$2-\frac{Zr}{a_0} = 0$

$2 = \frac{Zr}{a_0}$

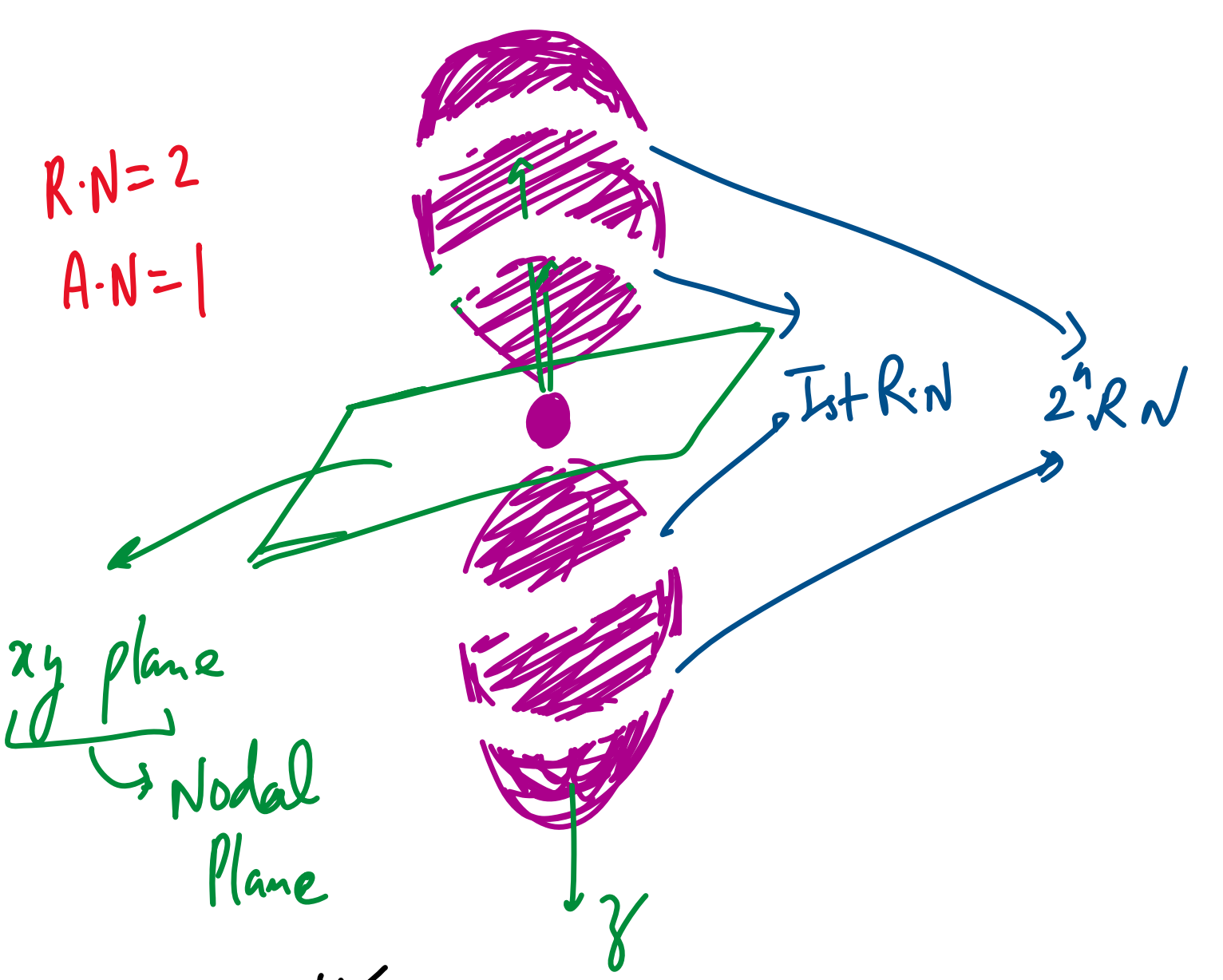
$\boxed{2a_0 = r}$ $\boxed{Z=1}$

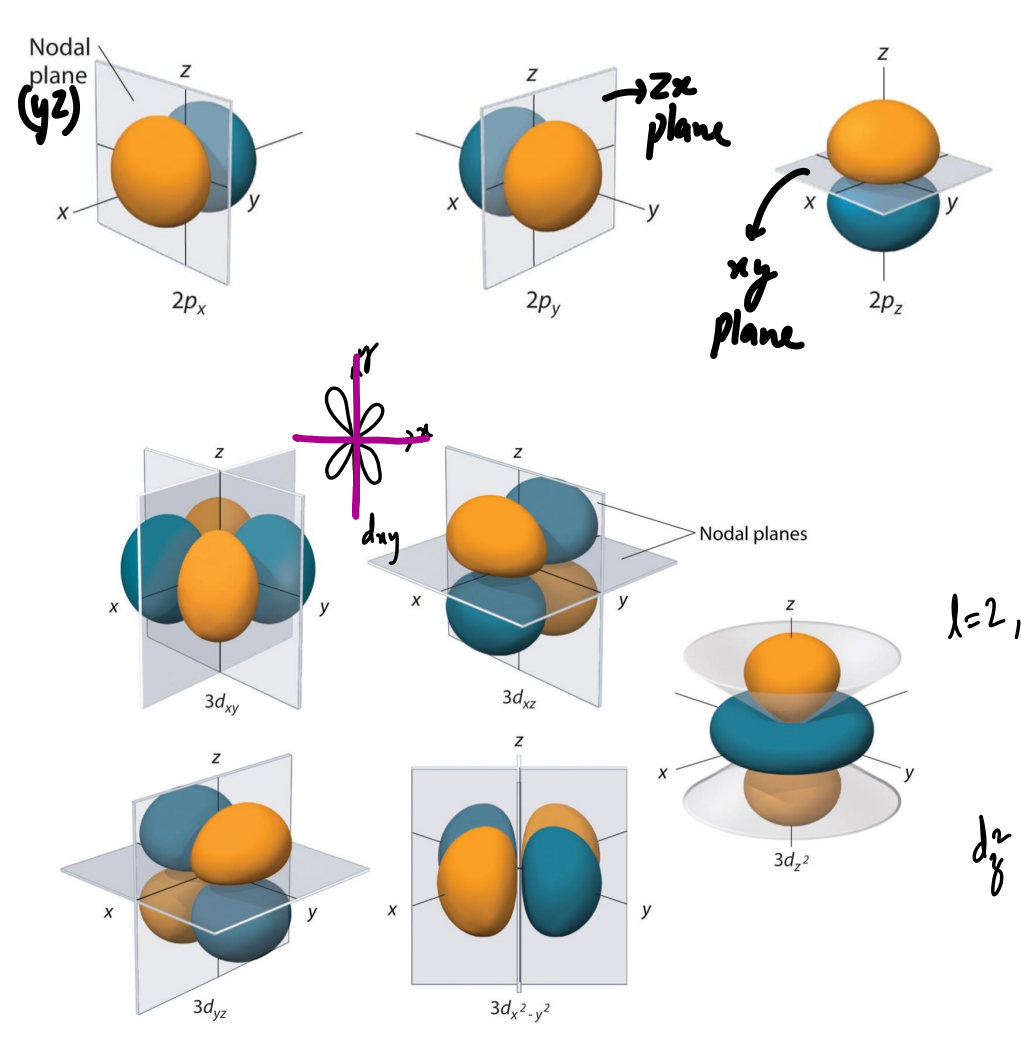
②s R·N=1 A·N=0

③s R·N=2 A·N=0



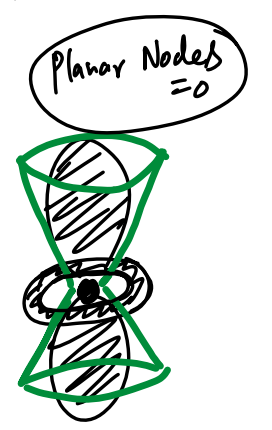
④p R·N=2 A·N=1





$l=2$, A·N=② ⇒ Conical Surface Nodes

Planar Nodes = 0



# $4d_{x^2-y^2}$

A·N=2

R·N=1